

## **Issue:**

**Which Channel Plan Should the FCC Adopt?**

1.6 MHz Based (FCC/Alcatel)

2.5 MHz Based (TIA/Joint Commenters)

**The Primary Difference Between the Alcatel Modified  
Plan and Joint Commenters' Plan is Channel  
Bandwidth Less Than 5 MHz**

<b>FCC Plan</b>	<b>JC Plan</b>	<b>Loading</b>
3.2 MHz	3.75 MHz	8 DS-1
1.6 MHz	2.50 MHz	4 DS-1
0.8 MHz	1.25 MHz	2 DS-1
0.4 MHz	-----	1 DS-1

## SPECTRUM EFFICIENCY FOR NARROWBAND SYSTEMS

FCC PLAN	NUMBER OF DS1's PER RF CHANNEL	NUMBER OF RF CHANNELS IN 30 MHZ	TOTAL DS1's IN 30 MHZ
5 MHZ	12	6	72
3.2 MHZ	8	12	72
1.6 MHZ	4	18	72
800 KHZ	2	36	72
400 KHZ	1	72	72

TIA PLAN	NUMBER OF DS1's PER RF CHANNEL	NUMBER OF RF CHANNELS IN 30 MHZ	TOTAL DS1's IN 30 MHZ
5 MHZ	12	6	72
3.75 MHZ	8	8	64
2.5 MHZ	4	12	48
1.25 MHZ	2	24	48

## NUMBER OF FREQUENCY PAIRS

### ALCATEL MODIFIED PLAN

RADIO CAPACITY	LONG PATHS				SHORT PATHS (1)		
	4 GHZ	6 GHZ	U6 GHZ	TOTAL	10.5 GHZ	11 GHZ	TOTAL
12 DS1	10	12	30	52	11	0	11
8 DS1	12	20	38	70	19	0	19
4 DS1	36	42	93	171	39	0	39
2 DS1	24	12	6	42	12	0	12
1 DS1	48	24	12	84	24	0	24

### TIA PLAN

RADIO CAPACITY	LONG PATHS				SHORT PATHS (1)		
	4 GHZ	6 GHZ	U6 GHZ	TOTAL	10.5 GHZ	11 GHZ	TOTAL
12 DS1	0	12	29	41	13	19	32
8 DS1	0	16	34	50	17	24	41
4 DS1	0	28	54	82	26	38	64
2 DS1	0	56	108	164	52	72	124
1 DS1	0	0	0	0	0	0	0

**NOTES:**

(1) THESE FREQUENCY BANDS ARE AFFECTED BY RAIN OUTAGE

**At the beginning, we listed goals the FCC could use to make the choice**

- **Optimal Spectral Efficiency**
- **Compatibility with Needs of Relocated 2 GHz Fixed Microwave Users**
- **Compatibility with Existing FCC Rules**
- **Fair and Open Competition for All Microwave Manufacturers**

**ALCATEL**  
NETWORK SYSTEMS

---

**We have shown you why the FCC/Alcatel plan  
satisfies those goals while TIA/JC's does not.**

**Which solution is the  
better long term  
strategy?**

**ALCATEL**  
NETWORK SYSTEMS

---

**FCC/Alcate**  
**microwa**  
**rest**



**Questions?**

**Specific Joint Commenters' (Reply) Comments  
Opposing Alcatel's Modified Plan**

The following observations have been taken from the ANS Reply Comments, ET Docket  
92-9, January 26, 1993, Technical Section, pages 16 through 26.

**1 - JC Comments:** The Proposed Channelization Plans Should Be Modified (JC/5/2)  
" ... the vast majority of U. S. microwave manufacturers do not produce equipment compatible with 1.6 MHz-based channels ... the proposed channelization plans have the effect ... of giving a competitive advantage to one manufacturer. To remedy this competitive imbalance, the Joint Commenters' recommend that the channelization plans be modified to incorporate 1.25 MHz-based channels." (JC/5/2) "... adoption of a 1.6 MHz-based channelization plan would have the effect of conferring a competitive advantage, at least in the near term, to a single manufacturer since the majority of U. S. owned manufacturers are not currently equipped to manufacture equipment compatible with 1.6 MHz channels." (JR/5/1)

**Alcatel's Reply:** This is not true. The technology required for the 1.6 MHz-based plan is 8 to 12 years old. As demonstrated in the main body of this presentation, all major manufacturers use that technology today. The Joint Commenters' proposal is quite inconsistent on the spectrum efficiency issue. **For all channel bandwidths of 5 MHz and greater, the Joint Commenters' and Alcatel's bandwidth proposals are identical.** The technology the Joint Commenters' despise for channel bandwidths below 5 MHz (64 QAM or 49 QPR) **must** be used to achieve the spectral density required by their plan for the larger bandwidth channels. It is easier to achieve the high spectral efficiency for narrow bandwidth channels. Why do the Joint Commenters relax the spectral efficiency for these channels? We can determine no manufacturing or user reason for this inconsistency.

**2 - JC Comments:** "There are other important reasons why a 1.25 MHz base channel plan is preferable." (JC/5/2) "... 1.25 MHz-based channels would correspond to the bandwidths employed in the 10 GHz channelization plan ..." (JC/5&6/2&1)

DS1's should use a 5 MHz bandwidth. However, the Joint Commenters advocate a 3.75 MHz channel plan for 8 DS1 systems and a 2.5 MHz plan for 4 DS1 systems. Alcatel does not support this change.

Note the Joint Commenters frequency plan for the 5.9 - 6.4 GHz band. There are a number of cases where a 3.75 MHz channel overlaps two 2.5 MHz, and 10 MHz channels. An example is the third 3.75 MHz channel from the left. This will cause fragmentation of the spectrum and result in blockage of various channels.

The Joint Commenters polarization plan for the 6.525 to 6.875 GHz operational fixed band. The 3.75 MHz channels again overlap 10, 5, and 2.5 MHz channels. There is also a potential problem with the interstitial 5 MHz channels. These channels were placed halfway between 10 MHz channels in the existing Part 94 channelization so that narrow band analog systems could be coordinated in the gap between channels. The Joint Commenters 2.5 MHz channels are not centered in the 5 MHz interstitial channels, so they cannot be used if the adjacent 10 MHz channels are used.

Note the frequency plan for the 5.9 - 6.4 GHz band using the Alcatel Modified Plan. Because each 5 MHz channel is subdivided into an odd number of 1.6 MHz channels, polarization conflicts will not occur between 1.6 and 5 MHz channels. The Modified Plan includes no overlapping 3.75 MHz channels to cause spectrum fragmentation. As a result, channels can be packed closer together and the overall spectrum efficiency of the band is improved.

The FCC Plan requires a minimum of 4 DS1's in a 1.6 MHz bandwidth. This allows a total of 72 DS1's to be coordinated in a 30 MHz bandwidth. The Joint Commenters Plan requires 4 DS1's in a 2.5 MHz bandwidth, resulting in a total of 48 DS1's per 30 MHz bandwidth. Thus, the FCC Plan inherently is more spectrally efficient.

Using the FCC Plan, systems can be upgraded from a 4 DS1 system in 1.6 MHz to an 8 or 12 DS1 system in 5 MHz without a frequency or polarization change. It is true that an 8 DS1 system occupying a 5 MHz channel is less spectrally efficient than an 8 DS1 system in a 3.75 MHz channel. However, this limitation is offset by other advantages. It also is possible to use 3.2 MHz concatenated channels for systems with no requirement for future growth.

Consider the frequency plan for the 6.525 - 6.875 GHz operational fixed band using the Alcatel Modified Plan. This figure demonstrates several unique characteristics of the plan. First, a system in the center 1.6 MHz channel could be upgraded to a 5 MHz or 10 MHz system without a frequency or polarization change.

Second, there is a 1.6 MHz channel centered in each 5 MHz interstitial channel. As a result, it would be possible to coordinate narrow band 4 - DS1 digital radios between two occupied 10 MHz channels like an analog system. Note that the spectrum occupancy of a 4-DS1 radio in 1.6 MHz is approximately the same as for a 132 channel FM system.

The Joint Commenters make a considerable issue out of the fact that a 1.6 MHz plan has "spectrum remnants." Since the channel bandwidth was rounded off to 1.6 MHz and  $3 \times 1.6 = 4.8$  MHz, there is a 0.2 MHz of "unused spectrum." Of course, this could be corrected by specifying a bandwidth of 1.6666666 MHz. However, we believe that this "correction" is unnecessary. The FCC Plan is inherently more spectrally efficient with or without spectrum remnants.

The Joint Commenters claim "... 1.25 MHz-based channels are preferable to 1.6 MHz-based channels in that they are more spectrum efficient." The Joint Commenters support this claim by showing that 0.8 and 1.6 MHz channels do not divide evenly into 5, 10, 20 or 30 MHz thereby leaving some unused "...large spectrum remnants." They calculate this "wasted spectrum" to be 1.2 MHz per 30 MHz channel. Their argument points out that 1.25 and 2.5 MHz channels have no spectrum remnants. However, with 1.25 MHz based channels, there are also 50% fewer channels available to users. This results in 10.8 MHz of "wasted spectrum" per 30 MHz channel or, stated another way, it will require 45 MHz total bandwidth to carry what could have otherwise been carried in 30 MHz under the 1.6 MHz based channels. The 1.25 and 2.5 MHz channels, therefore, do not appear to be more spectrum efficient than 0.8 and 1.6 MHz channels.

These spectrum remnants also allow 1.6 MHz channels to be defined without overlap in the 6 GHz common carrier band, as proposed in the Alcatel Modified Plan. The Joint Commenters' plan has spectrally inefficient and wasteful overlap.

Given the uncertainty whether adequate spectrum will be available in the bands above 3 GHz for fixed microwave operation, it is imperative that the most spectrally efficient plan be adopted. Based on technical merits, a channelization plan based on 1.6 MHz bandwidths is the most efficient plan.

**4 - JC Comments:** "That plan should be revised ... to accommodate more adequately the expected requirements of 2 GHz migrants ..." (JC/7/2)

**Alcatel's Reply:** We agree. That is one of the strongest arguments for adopting the Alcatel Modified Plan. To further clarify this point, Alcatel commissioned Comsearch to provide additional details of the existing users in the 2 GHz bands. There are 13,208 frequencies currently (as of late 1992) licensed in the 2130-2150, 2180-2200 MHz private/op fixed band. Of these, 6,340 (48%) occupy 1.6 MHz and 6,208 (47%) occupy 0.8 MHz. The remainder used a variety of other bandwidths. This indicates that there is a huge installed base of radios using 1.6 MHz and 800 kHz bandwidths.

If all of these 0.8 and 1.6 MHz users were moved to higher frequencies using 1.25 and 2.5 MHz bandwidths rather than 0.8 and 1.6 MHz bandwidths, it would require 8.5 GHz of additional spectrum to accommodate them. This does not seem to be in the long-term best interest of microwave users or manufacturers. Furthermore, 87% of the private analog 2 GHz frequencies (approximately 21,566) and all of the common carrier digital 2 GHz frequencies can be accommodated in channel bandwidths of 5 MHz or less. This is why the maximum number of narrow band channels that can be accommodated in the remaining spectrum is required. This is also why Alcatel suggested 1.6, 0.8 and 0.4 MHz channel bandwidths.

Low capacity systems are defined as carrying 1 or 2 DS1's of digital traffic, or an equivalent 24 to 48 channels of 4 KHz analog voice traffic. The Joint Commenters proposed that the 800 and 400 KHz channels in the FCC Plan be replaced with 1.25 MHz channels. Alcatel opposes this change.

The FCC Plan has a fundamentally different approach to accommodating low capacity systems than the Joint Commenters Plan. Alcatel places all low capacity channels in reserved spectrum. For example, in the 6 GHz common carrier band, low capacity channels are placed at the band edges and in the center gap so that medium and high capacity channels would not be blocked (i.e., 1.6, 5, 10, and 30 MHz channels).

Similarly, at upper 6 GHz, the existing band edge channels are retained for low capacity systems. At 4 GHz and 10 GHz, two 5 MHz blocks of spectrum are reserved specifically for low capacity systems. No low capacity channels are provided in the 11 GHz band, which is reserved for high capacity systems carrying 1 DS3 or more.

The Joint Commenters Plan spreads low capacity 1.25 MHz channels across a full 80 MHz of the 6 GHz common carrier band. It also extends low capacity channels across the entire upper 6 GHz private band and the 10.55 - 10.68 GHz band.

Alcatel does not believe that the Joint Commenters plan provides a proper balance between low capacity, medium capacity, and high capacity systems. We are particularly concerned that if the WARC-92 allocations are followed and the 2.13 - 2.2 GHz private band is reallocated for Mobile Satellite Services (MSS), a mass relocation of low capacity systems may become necessary to clear band. Current MSS systems operating in the 1530 - 1660 MHz band do not allow sharing between MSS and fixed point-to-point services. \*

According to a FCC Office of Engineering and Technology report,\*\* there are approximately 13,000 low capacity systems in the 2.13 - 2.2 GHz private band using bandwidths of 800 KHz and 1.6 MHz. Under the Joint Commenters Plan, a mass relocation of these systems could cause severe spectrum fragmentation across the entire 6 GHz common carrier and private bands, making it difficult to coordinate wider channels. The FCC Plan would direct these lower capacity systems to reserved parts of the spectrum and would preserve wider channels.

Most of the low capacity systems in the 2.13 - 2.2 GHz private band are analog. Although Alcatel believes that many of the relocated systems will convert to digital, a significant percentage may remain analog. Analog radios for low capacity applications are low cost and spectrally efficient, can easily use 800 and 400 KHz bandwidths, and will remain a viable option for many years to come. From a spectrum management viewpoint, it is preferable to concentrate analog radios in particular sections of the spectrum to avoid carrier beat problems. The FCC Plan achieves this objective.

Comsearch frequency data indicate that, out of the 10,783 analog paths licensed in the 1.85 - 1.99 and 2.13 - 2.2 GHz operational fixed bands, 4028 paths carry 48 voice channels or less (37% of the total). In contrast to the opinion stated by the joint commenters, there are a large number of low capacity systems licensed in these bands. The channelization plan adopted must accommodate these systems.

Currently, no radio manufacturer offers a 1 or 2 DS1 digital radio that will occupy a 400 or 800 KHz channel. As a result, no manufacturer has an unfair advantage in the low capacity market. The spectrum efficiency requirements proposed for 1 and 2 DS1 radios are the same in bits/hertz as the requirements for 4, 8, and 12 DS1 radios. Therefore, the same modulation methods can be used.

---

\* John H. Lodge, "Mobile Satellite Communications Systems: Toward Global Personal Communications," IEEE Communications Magazine, November 1991, pp.24-30.

\*\* Federal Communications Commission, "Creating New Technology Bands for Emerging Telecommunications Technology," OET/TS 91-1, pg.8.

In our research for this report, Alcatel was unable to identify any radios that have been type accepted for a 1.25 MHz bandwidth. The only radio we could find that could actually use 1.25 MHz is a Harris Farinon 1-DS1 radio which is actually type accepted for an 800 KHz bandwidth. We conclude that certain manufacturers have 1.25 MHz radios in the R&D pipeline, but few currently are using these channels.

Alcatel recognizes that these manufacturers would like to leverage their investments in 10 GHz radios and use the same 1.25 MHz modulator designs in other frequency bands. For these manufacturers, we propose that they be permitted to use 1.25 MHz radios in 1.6 MHz channels during the two-year transition period.

**5 - JC Comments:** "... create several 15 MHz channels ... 15 MHz channels would provide another channel option between the 10 and 30 MHz bands, and thus avoid the need for channel concatenations ..." (JC/8/1) "... these 15 MHz channels should be phased-out after that 5 year transition period ..." (JC/6/4)

**Alcatel's Reply:** First, we add a new low spectral efficiency 15 MHz channel plan for unknown reasons. Next we phase it out. What is the purpose of this?

**6 - JC Comments:** "... microwave systems employing 400 or 800 kHz channels would not be practical from an economic standpoint ..." (JC/8/2)

**Alcatel's Reply:** We disagree. If that is true, the channels will not be used. Leave the channels in and let the market decide. Since the concatenation of 400/800 kHz channels creates the 1.6 MHz and higher channels, no spectrum will be wasted regardless of what the market decides.

**7 - JC Comments:** "... provide a substantial number of 40 MHz channels to accommodate the needs for very high capacity systems ..." (JC/8/3)

wide band utilization. Moving narrow bandwidth channels into the 11 GHz band is unnecessary.

**9 - JC Comments:** "This [11 GHz] channelization plan is modeled after the plan for the lower 6 GHz band ..." (JC/9/3)

**Alcatel's Reply:** Why? Earlier we were lead to believe that the 10 GHz band was the appropriate model for channelization.

**10 - JC Comments:** "...the channelization plan proposed herein will permit users with diverse needs to use 11 GHz frequencies. This plan will also have the added benefit of reducing congestion in the 6 GHz band, the only other low frequency allocation with 10 MHz bandwidth channels." (JC/9&10/2&1)

**Alcatel's Reply:** With so much spectrum available at 10 GHz, there is no need to proliferate low density users in 11 GHz. Do the Joint Commenters' really believe 11 GHz can be used as a practical alternative to 6 GHz? As every transmission engineer knows, 11 GHz never will be an adequate substitute for that band. The 11 GHz band is far too prone to rain (and multipath) outage.

**11 - JC Comments:** "Channel Concatenations Generally Should Not Be Allowed ... a policy that generally prohibits channel concatenations will increase spectrum utilization by minimizing the creation of "splinter channels" created by the assignment of non-standard channels." (JC/10/2)

**Alcatel's Reply:** We disagree. Alcatel proposes the concept of concatenation to allow the industry some flexibility in defining new channelization plans without requiring a lengthy petition process through the FCC. Permitting concatenated channel plans also would reduce the FCC's workload. We note that this is the second rechannelization of the 10.55 to 10.68 GHz band in three years.

Under our concept, the 400 KHz, 1.6 MHz, and 10 MHz channels would become basic building blocks for low capacity, medium capacity, and high capacity systems respectively. These "building blocks" could be used to construct wider channels to solve particular spectrum management problems in the industry or to accommodate future advances in radio technology.

**12 - JC Comments:** "Applicants for Wideband Channels in Bands Under 15 GHz Should Be required to Submit Extensive Justification and Be Subject to Stringent Channel Loading Requirements" (JC/11/2) "... applicants for wideband channels (15 MHz and greater) should be required to submit more extensive justification than other applicants ... wideband applicants should be required to demonstrate that their stated communications requirements cannot be satisfied with a narrower channel. ... Part 94 applicants who plan to resell excess capacity should be required to submit contracts with their applications evidencing concrete demand for such capacity." (JC/11&12/3&1) "... more stringent channel loading requirements must be adopted for wideband assignments" (JC/12/2)

**Alcatel's Reply:** This is an amazingly self-serving proposal which can help no one except the Joint Commenters. This tends to force the utilization of less spectrally efficient channels so the public is not well served. It forces the users to give a list of their customers to their competitors so they are not well served. We can not help but notice that none of the Joint Commenters, with one exception, have any radios which would be affected by this proposal (none of them, with one exception, have radios with channel bandwidth 15 MHz or greater). The one exception is DMC, with their 15 MHz channel bandwidth radio.



**Alcatel's Reply:** We are proposing a phased approach. The two-year time frame we proposed appears appropriate since that is the approximate amount of time allowed in 1974 for a similar transition.

As a compromise to manufacturers who purport to have an equipment investment in 1.25 and 2.5 MHz bandwidth radios, Alcatel offers the following suggested amendment:

For two years following the conclusion of these proceedings, the minimum payload capacity in 3.2 and 1.6 MHz channels is reduced by one-half to 4 DS1's and 2 DS1's, respectively.

This would allow manufacturers designing to use 1.25 and 2.5 MHz bandwidth to use 1.6

Although the Joint Comment statement regarding cost is, strictly speaking, correct, their conclusion is false. There is no significant cost difference for the radios being proposed by either party.

**18 - JC Comments:** "Consistent with this view, the Commission should adopt technical rules and channelization plans that maximize efficient use of the spectrum while ensuring that equipment designed to meet the established efficiency standards can be manufactured at a reasonable cost. In contrast to the 1.6 MHz-based channelization plan proposed in the Notice, the efficiency standards implicit in the Joint Commenters' channelization plan provided the Commission the flexibility to balance these public interest consideration. High spectral efficiency (bit/Hertz) should not be attained at the expense of reasonable equipment cost and path reliability. The high spectral efficiency (bit/Hertz) of Alcatel's channelization plan appears impressive at first glance.. However, when path reliability and the cost of manufacturing a radio designed to meet such efficiency specification is taken into account it becomes apparent that these efficiency standards are contrary to the public interest." (JR/9/1)

**Alcatel's Reply:** Again, the Joint Commenters are wrong. See previous comment regarding cost. See the main body of this presentation regarding path reliability.

**19 - JC Comments:** "Radios designed to meet the efficiency standards of the Alcatel channelization plan will be more expensive than radios designed to meet the efficiency standards of the Joint Commenters' plan. There is no flexibility in the Alcatel plan for inexpensive, yet, reasonably spectrally efficient radios to be manufactured for uncongested areas. In contrast, the Joint Commenters' proposal provides the flexibility for reasonably priced, highly reliable radios to be manufactured for uncongested areas and more spectrally efficient, complex and costlier radios to be manufactured for congested areas. Indeed, the Joint Commenters' have introduced 6 T1 and 12 T1 radios at 6 And 10 GHz which are more spectrally efficient that the Commission's rules require for those customers located in very congested areas." (JR/9/2)

**Alcatel's Reply:** Again, see previous comment regarding cost. The Joint Commenters propose channel plan which requirese on type of dtechnology for narrow band channels and another for wide bands. As a manufacture we would like to point out that producing two types of technology rather than one is invariably more expensive. Test and inventor go up while per unit volume goes down. The Joint Commenters are proposing an less cost effective approach.

**20 - JC Comments:** "Moreover, unlike the 1.6 MHz channelization plan, the Joint Commenters' 1.25 MHz-based channelization plan does not sacrifice path reliability. Under the Alcatel plan, power amplifiers and filters have to be more linear as the modulation scheme increases. As the modulation scheme increases, the system gain of the radios decreases and path reliability, which is critical to displace users of the 2 GHz band, is diminished." (JR/9/3)

**Alcatel's Reply:** Again, see the main body of the presentation regarding this incorrect statement.

**21 - JC Comments:** "Alternatively, if the Commission elects to sacrifice path reliability and lower equipment costs for higher spectral efficiency, then using state-of-the-art modulation technology, the Joint Commenters" could modify their plan to produce equipment with greater efficiency. Regardless of the spectral efficiency standards adopted by the Commission, the Joint Commenters'" 1.25 MHz-based channelization plan should be adopted because it does not waste valuable spectrum by leaving inefficient spectrum remnants." (JR/9/4)

**Alcatel's Reply:** We disagree that any significant sacrifice is necessary with our plan. We are pleased to see that the Joint Commenters could produce equipment necessary to meet the spectral efficiency of the Alcatel Modified Proposal. However, we note that this only requires 64 QAM or 49 QPR. That is hardly state-of-the-art technology. All major manufacturers have been using that technology for at least 8 years.

**22 - JC Comments:** "A Channelization Plan Based on 1.25 MHz Channels Serves the Public Interest by Promoting Efficient Use of Scarce Spectrum and Utilizing Manufacture's Existing Capabilities" (TC/5/2)

**Alcatel's Reply:** As you might expect, we do not concur. The Joint Commenters have suggested that the Alcatel proposed narrow channel bandwidths of 1.6, 0.8, and 0.4 MHz were selected to accommodate existing Alcatel equipment and limit competition from other manufacturers. This is untrue. The selection of these narrow channel bandwidths was derived from existing FCC Part 21 rules and regulations.

Part 21.122, Microwave digital modulation, defines several requirements for transmitters employing digital modulation techniques. Part 21.122(a) (1) requires a minimum bandwidth efficiency of 1 bit/sec/Hz calculated using the emission designator of the radio. This has become a very easy specification to meet.

Part 21.122(a) (2) requires that any digital transmitter used to carry voice traffic must be capable of carrying a minimum of 1152 voice circuits in the maximum authorized bandwidth of the common carrier 4, 6, and 11 GHz bands. This requirement effectively supersedes 21.122(a) (1) and establishes the minimum bandwidth efficiency in these bands.

Part 21.122(a) (3) requires that any digital transmitter used to carry data traffic must be capable of carrying a minimum of 1152 data circuits in the maximum authorized bandwidth of the common carrier 4, 6, and 11 GHz bands.

21.122(a)(3) Factor "N"	Max Authorized Bandwidth (MHz) at			Required Minimum Number of Voice Channels	Equivalent Number of DS1 Circuits
	4 GHz	6 GHz	11 GHz		
1	20	30	40	1152	48
2	10	15	20	576	24
3	6.67	10	13.33	384	16
4	5	7.5	10	288	12
6	3.33	5	6.67	192	8
12	1.67	2.5	3.33	96	4
24	0.83	1.25	1.67	48	2
48	0.42	0.63	0.83	24	1

Initial digital radio development in the early to mid 1970's concentrated in the 11 GHz band to take advantage of the wider authorized bandwidth. The most successful of these radios used 8 PSK modulation which, when filtered properly, could also be squeezed into the 30 MHz authorized bandwidth at 6 GHz. Later technology allowed the development of 16 QAM radios in the 30 MHz bands at 6 GHz. However, both 8 PSK and 16 QAM were limited and could only carry 2 DS3's (1344 voice circuits) in the authorized 30 MHz. In order to increase the bandwidth efficiency sufficient to carry an additional DS3 (3 DS3 total), radio designers were forced to use either 64 QAM or 49 QPR modulation

Recently, many radios in the 2 GHz band have been coordinated for 3.5 MHz bandwidths. The Joint Commenters note that, in 1991, approximately 70 percent of the frequency coordinations in the 2 GHz band used 3.5 MHz bandwidths. Most of these coordinations were for cellular interconnects in the common carrier portion of the band. Due to the fast growing nature of these systems, cellular operators have demanded radios with the capability to upgrade quickly from 4 DS1 to 8 or 12 DS1 capacity. Since the existing 1.6 MHz channel plan is offset from the 3.5 MHz plan, it is necessary to change frequencies to upgrade a system if the 1.6 MHz plan is used. As a result, most systems have tended to use the 3.5 MHz plan for all applications.

Alcatel, Harris-Farion, and Telesciences have been the major suppliers of these 2 GHz systems. As shown, both Alcatel and Harris Farion manufacture 4-DS1 radios in the 2 GHz band which occupy 1.6 MHz of bandwidth. Telesciences has an 8 QAM version which occupies a full 3.5 MHz of bandwidth and a 64 QAM version which occupies 1.6 MHz.

The Joint Commenters appear to minimize the importance of capacity upgrades in their comments. This is understandable, given the clear disadvantages of their proposed plan in this regard.

Based on our past experience with the cellular industry, the merging PCS market likely will require a large number of point-to-point microwave radios to interconnect cell sites outside of core urban areas. PCS would be very similar to the early days of the cellular industry with various system operators rushing to complete their networks and consumer demand for new services increasing at a rapid pace. In such an environment, the ability to upgrade the capacity of microwave radios will be very important.

In summary, the 1.6 MHz bandwidth has been used in various microwave bands for many years. Several of the major radio manufacturers currently are offering equipment using 1.6 MHz bandwidths. Manufacturers without 1.6 MHz products should be able to adapt existing modulation processes for these bandwidths without undue hardship if a reasonable transition period is provided.

**23 - JC Comments:** "Based on TIA members' first-hand industry experience, following a 1.6 MHz-based plan will be certain to result in significant spectrum waste. In 1991, more than 70 percent of the 2 GHz digital microwave systems licensed used 3.5 MHz bandwidth channels. These systems, assuming comparable bandwidths needs, will use three 1.6 channels (4.8 MHz) or a 5.0 MHz channel under a 1.6 MHz-based plan." (TC/6/2)

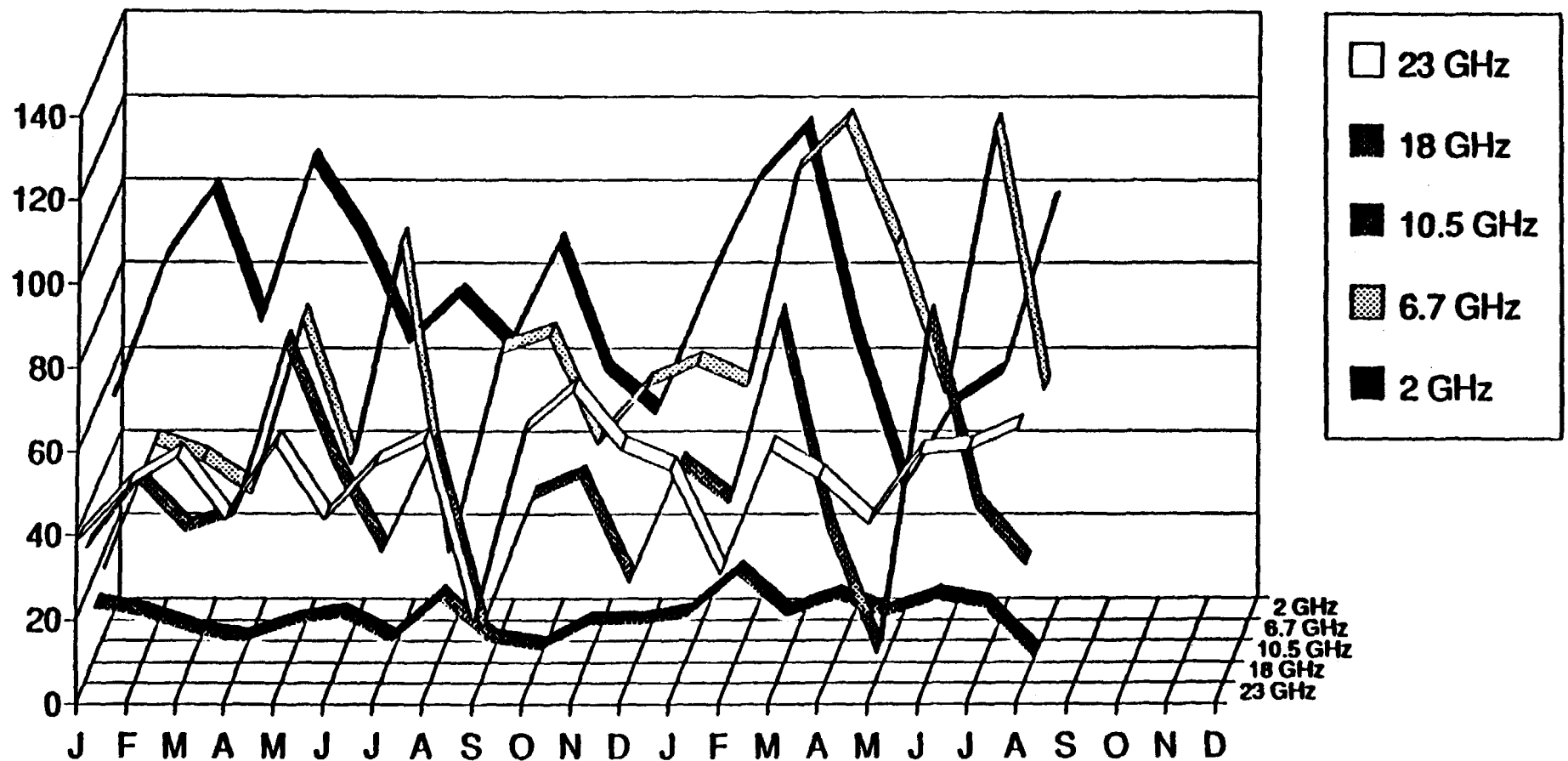
**Alcatel's Reply:** We do not understand the significance of sales in the year 1991. We suggest looking at the existing 2 GHz customer base. According to the FCC Office of Engineering and Technology report "Creating New Technology Bands for Emerging Telecommunications Technology," OET/TS 91-1, p.8, there are approximately 13,000 low capacity systems in the 2.13 - 2.2 GHz private band using bandwidths of 800 KHz and 1.6 MHz. Alcatel commissioned Comsearch to provide additional details of the existing users in the 2 GHz bands. There are 13,208 frequencies currently (as of late 1992) licensed in the 2130-2150, 2180-2200 MHz private/op fixed band. Of these, 6,340 (48%) occupy 1.6 MHz and 6,208 (47%) occupy 0.8 MHz. The remainder used a variety

frequencies (approximately 21,566) and all of the common carrier digital 2 GHz frequencies can be accommodated in channel bandwidths of 5 MHz or less. This is why the maximum number of narrow band channels that can be accommodated in the remaining spectrum is required. This is also why Alcatel suggested 1.6, 0.8 and 0.4 MHz channel bandwidths.

**24 - JC Comments:** "... wideband applicants in these bands (below 15 GHz) should be required to (1) demonstrate that their system requirements cannot be satisfied with narrow channels, and (2) submit a channel capacity implementation plan showing that at least 50 percent of the initial capacity of the wideband channels will be used upon licensing. ... Alternative enforcement mechanisms include allowing potential applicants to pay for a loading audit by either the Commission or "FCC certified auditors" for a final determination. Under this approach, the auditors would conduct an audit to be included in a report to the Commission of the actual usage of existing licensees." (TC/10/1)

**Alcatel's Reply:** See comment 12 regarding this self serving proposal.

## Transmit Frequencies Coordinated Private Op-Fixed Bands



**Figure 2 - Private Op-Fixed Paths Coordinated by Band**

From ANS Comments, ET Docket 92-9, December 11, 1992

## **Comment Convention**

**(XX/YY/ZZ)**

**XX = Reference from below**

**YY = page from reference**

**ZZ = paragraph from page**

**JC = Joint Comments of Harris Corporation-Farinon Division, Digital Microwave Corporation and Telesciences, Inc, December 11, 1992.**

**JR = Reply Comments of Telesciences, Inc., Harris Corporation-Farinon Division and Digital Microwave Corporation, January 27, 1993.**

**Except as noted on the following pages, the following (Reply) Comments are a rewording of the above (Reply) Comments**

**TC = Comments of the Telecommunications Industry Association (TIA) Fixed Point to Point Communication Section (Harris Corporation-Farinon Division, Digital Microwave Corporation, Telesciences, Inc and Northern Telecom), December 11, 1992.**

**TR = Reply Comments of the Fixed Point-to-Point Communications Section of the Telecommunications Industry Association (TIA) Fixed Point to Point Communication Section (Harris Corporation-Farinon Division, Digital Microwave Corporation, and Telesciences, Inc), January 27, 1993.**



### **3.7 - 4.2 GHZ FREQUENCY PLANS**

#### **JOINT COMMENTERS PLAN**

- Adds 40 MHz wide band channels across the entire band. This option is strongly opposed by satellite interests.
- Eliminate all 10 MHz channels. This action prevents Alcatel from selling its existing 1 DS3 radio.
- Eliminates all narrow band channels.

#### **ALCATEL MODIFIED PLAN**

- Maintains the existing 20 MHz channel spacing to reduce terrestrial into satellite interference.
- Relocates the 10 MHz channels and narrow band channels to allow satellite receivers to use "TI filters".
- Corrects the channel pairing problem described by Comsearch.
- Allows standard "high/low" frequency pairings to be used for low capacity microwave systems. This allows a single antenna to be shared for transmitters and receivers.
- Allows the old AT&T channel pairing plan to be used for high capacity interexchange systems. This requires separate transmit and receive antennas on every path.
- Allows future use of the adjacent 3.6 to 3.7 GHz government band.